

AMENDMENT AND RESPONSE UNDER 37 CFR § 1.111

Serial Number: 10/052089

Filing Date: January 16, 2002

Title: A WIRE-BONDABLE PROCESS FLOW COMPATIBLE WITH CU-M6

Assignee: Intel Corporation

Page 2
Dkt: 884.659US1 (INTEL)IN THE CLAIMS

Please amend the claims as follows;

1. (Canceled)

2. (Currently Amended) ~~The process according to claim 1, further including:~~ A process of forming a wire bond comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film;

at the metal second film, wire bonding the device; and

by probing the metal second film, electrically testing the device.

3. (Canceled)

4. (Currently Amended) ~~The process according to claim 1~~ A process of forming a wire bond comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film; and

at the metal second film, wire bonding the device, wherein the metallization copper pad is a metal-six copper (M6 Cu) pad.

5. (Currently Amended) ~~The process according to claim 1~~ A process of forming a wire bond comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal

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B2 first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film; and

at the metal second film, wire bonding the device, wherein forming a protective passivation structure includes:

forming a first passivation layer over the metallization copper pad;
forming a second passivation layer over the metallization copper pad; and
patterning the first and second passivation layers to expose at least a portion of the metallization copper pad.

6-8. (Cancelled)

B3 9. (Currently Amended) ~~The process according to claim 1~~ A process of forming a wire bond comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film; and

at the metal second film, wire bonding the device, wherein the metal first film is electrolessly plated with a composition including:

from zero to at least one primary metal selected from cobalt, rhenium, iridium, nickel, palladium, platinum, titanium, zirconium, hafnium, copper, silver, gold, and combinations thereof;

from zero to at least one secondary metal selected from chromium, molybdenum, tungsten, manganese, technetium, rhenium, and combinations thereof;

from zero to at least one primary reducing agent in a concentration range from about 1 gram/liter to about 30 gram/liter;

from zero to at least one secondary reducing agent in a concentration range from about 0 gram/liter to about 2 gram/liter;

a complexing and buffering agent; and

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at least one pH adjusting agent.

10-23. (Canceled) /

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24. (Currently Amended) ~~The process of claim 1, further including:~~ A process of forming a wire bond comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film;

at the metal second film, wire bonding the device; and

by probing the metal second film, electrically testing the device, wherein the test probe tip penetrates the metal second film and stops before penetrating the metal first film.

25. (Currently Amended) ~~The process according to claim 1, further including:~~ A process of forming a wire bond comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film;

at the metal second film, wire bonding the device;

by probing the metal second film, electrically testing the device; and

following passing a test current, further including:

first bonding a first bond wire to the metal second film.

26. (Currently Amended) ~~The process according to claim 1, further including:~~ A process of forming a wire bond comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal

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first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film;

at the metal second film, wire bonding the device;

by probing the metal second film, electrically testing the device; and
following passing a test current, further including:

first bonding a first bond wire to the metal second film;

removing the first bond wire; and

second bonding a second bond wire to the metal second film.

27. (Currently Amended) ~~The process according to claim 1,~~ A process of forming a wire bond comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film;

at the metal second film, wire bonding the device;

wherein forming a protective passivation structure includes:

forming a first passivation layer over the metallization copper pad;

forming a second passivation layer over the metallization copper pad; and

patterning the first and second passivation layers to expose at least a portion of the metallization copper pad, wherein patterning the first and second passivation layers forms a slope that has an angle in a range from about 30° to about 60°.

28-30. (Canceled).

31. (Currently Amended) ~~The process according to claim 1, further including:~~ A process of forming a wire bond comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal

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first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film;

at the metal second film, wire bonding the device

by probing the metal second film, electrically testing the device;

first bonding a first bond wire to the metal second film;

removing the first bond wire; and

second bonding a second bond wire to the metal second film.

32. (Currently Amended) The process according to ~~claim 1~~ claim 31, further including:

~~by probing the metal second film, electrically first testing the device;~~

~~first bonding a first bond wire to the metal second film;~~

~~removing the first bond wire;~~

~~second bonding a second bond wire to the metal second film; and~~

by probing the metal second film, electrically second testing the device, wherein

electrically second testing the metal second film includes an ohmic resistance change in a range from about 50% reduction to about 150% improvement over electrically first testing the device.

33. (Previously Presented) A process comprising:

forming a protective structure over a metallization copper pad, wherein the metallization copper pad makes contact with a device, and wherein the protective structure includes a metal first film disposed above and on the metallization copper pad and a metal second film disposed above and on the metal first film; and

at the metal second film, wire bonding the device;

wherein the metal first film is electrolessly plated with a composition including:

from zero to at least one primary metal selected from cobalt, rhenium, iridium, nickel, palladium, platinum, titanium, zirconium, hafnium, copper, silver, gold, and combinations thereof;

from zero to at least one secondary metal selected from chromium, molybdenum, tungsten, manganese, technetium, rhenium, and combinations thereof;

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from zero to at least one primary reducing agent in a concentration range from about 1 gram/liter to about 30 gram/liter;

from zero to at least one secondary reducing agent in a concentration range from about 0 gram/liter to about 2 gram/liter;

a complexing and buffering agent; and

at least one pH adjusting agent.

34. (Previously Presented) The process according to claim 33, further including:
by probing the metal second film, electrically testing the device.
35. (Previously Presented) The process according to claim 33, wherein the metal first film is nickel, and wherein the metal second film is gold.
36. (Previously Presented) The process according to claim 33, wherein the metal first film is titanium, and wherein the metal second film is aluminum.